INSTRUCTION MANUAL

SD117A

AUTOMATIC LEVEL PROGRAMMER

JFH

SPECTRAL DYNAMICS CORPORATION

Douglas –
c/o Jim Miller
TWO 55606

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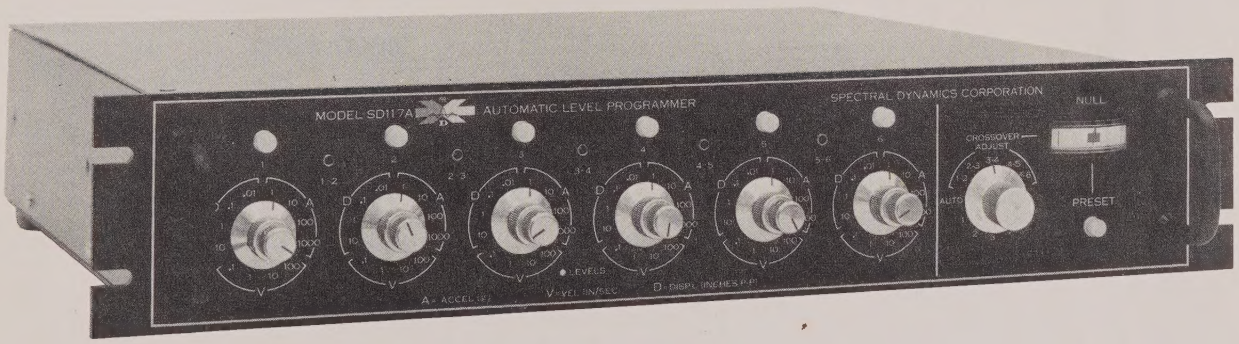

MODEL SD117A AUTOMATIC LEVEL PROGRAMMER

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DWG. NO. 11478 Schematic/Component Layout (3 Sheets) . . . . . Rear

RECEIVING INSPECTION PROCEDURE

The Model SD117A Automatic Level Programmer is shipped fully assembled, packed in a polystyrene case designed to protect it against all normal shipping hazards. Immediately upon receipt, inspect the exterior of the shipping case and note any visible damage. Keep all forms and invoices attached to the shipping case. Remove the instrument from the shipping case and test its functional operation in accordance with Section II of this manual. If shipping damage is apparent, file a claim with the carrier's claims agent and send a copy to Spectral Dynamics Corporation. Be sure to include the instrument name, model number, and serial number on all correspondence. Spectral Dynamics Corporation will advise the buyer what should be done; arrangements for repair or replacement will be made as applicable.

WARRANTY POLICY

All Spectral Dynamics products are warranted against defects in materials and workmanship. This warranty applies for one year from the date of delivery, or, in the case of certain components listed in some of the operating manuals, for the specified period. We will repair or replace products which prove to be defective during the warranty period, providing the failure or damage has not been caused by misuse or abnormal operating conditions. Fuses and lamps are specifically excluded from warranty. If the malfunction or a portion thereof is determined by Spectral Dynamics Corporation to have been caused by misuse or abnormal conditions of operation, an estimate of cost to repair will be submitted to the purchaser for approval before beginning any repair work.

Liability under this warranty is limited to servicing and adjusting the instrument returned to the factory, with transportation charges prepaid by the purchaser. No other warranty is expressed or implied. We are not liable for consequential damages.

If any malfunction develops, notify Spectral Dynamics Corporation or its representative in your area, giving details of the problem, and the name, model and serial number of the equipment. Upon receipt of this information, service data or shipping instructions will be provided.

RETURN SHIPMENT PROCEDURE

On receipt of shipping instructions, forward the instrument prepaid via air freight to the factory or authorized repair station indicated on the instructions. Replace the instrument in its original shipping case, or surround with two to three inches of shock absorbing material and then pack it in a heavy-weight cardboard box, wooden box, or other strong container.

SECTION I

GENERAL INFORMATION

1.1 INTRODUCTION

The Model SD117A Automatic Level Programmer (ALP) provides a means of programming six manually preset levels of acceleration (A), velocity (V) or displacement (D). It was specifically designed for use with a Model SD114A Sweep Oscillator Servo. Figure 1-1 shows the Model SD117A ALP operating with an SD114A to control a single vibration exciter system.

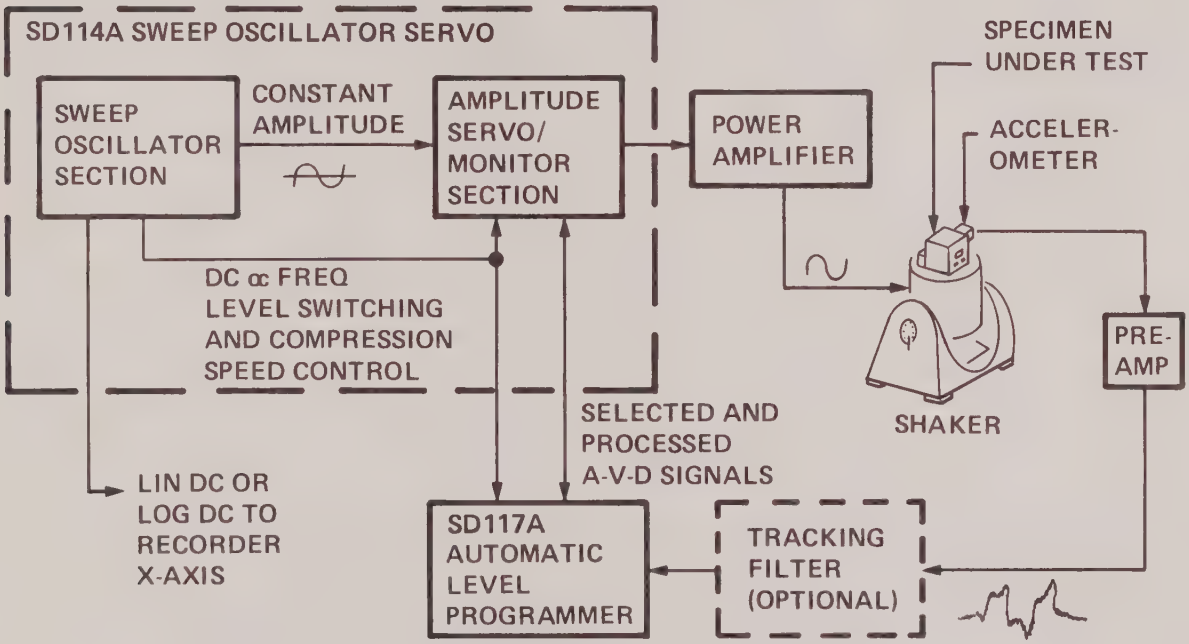
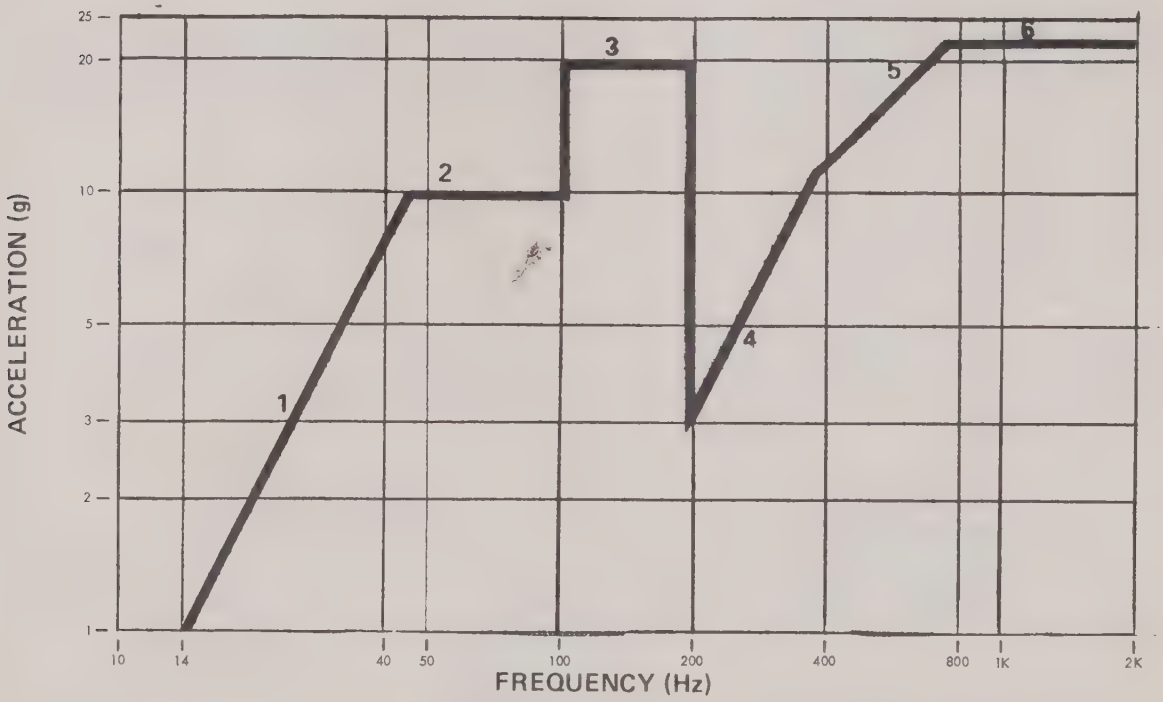


Figure 1-1. Model SD117A Automatic Level Programmer in System Concept

Note that the SD117A ALP is in a servo loop that comprises (in sequence) the SD114A, a power amplifier, a shaker, a specimen under test with attached accelerometer, a tracking filter (optional), and the SD117A ALP. In this setup, the following sequence of events occurs: The Sweep Oscillator Section of the SD114A sweeps up through the desired frequency range (for example 5 Hz to 2 kHz). The sweep oscillator output is routed through the Amplitude Servo/Monitor Section of the SD114A and then to the power amplifier causing the shaker to vibrate the specimen under test. The output of the accelerometer attached to the specimen under test is applied to the SD117A ALP. (A tracking filter, Model SD101B Dynamic Analyzer, is usually employed here to provide a filtered signal output at the system excitation frequency.)

The accelerometer signal is routed through the SD117A to the SD114A where it is electronically processed to produce a-c signals proportional to velocity (V) and displacement (D). The input acceleration (A) signal and the developed velocity (V) and displacement (D) signals are returned to the SD117A and applied to the six front-panel A-V-D Range switches. These switches and associated potentiometers facilitate presetting a 6-level vibration analysis program. The test level profile of a typical program is shown below.



In the program illustrated above, the preset test parameters, frequency range, and approximate crossover frequency for each level are as follows:

Level	Preset Parameter	Freq Range (Hz)	Crossover Freq
1	DISPL, 0.1 in. p-p	14–44	44
2	ACCEL, 10g	44–100	100
3	ACCEL, 20g	100–200	200
4	DISPL, 0.00145 in. p-p	200–406	406
5	VEL, 1.85 in./s	406–734	734
6	ACCEL, 22g	734–2,000	------

During programming, the exact crossover frequency need not be computed. A smooth transition between levels is facilitated by means of the front-panel NULL meter and associated switches and controls. This feature allows the crossover point (frequency) to be accurately set electronically, thus eliminating the possibility of a "thump".

1.2 FRONT PANEL FUNCTIONAL DESCRIPTION

Figure 1-2 illustrates the instrument front panel followed by a brief description of each of the front panel functions.

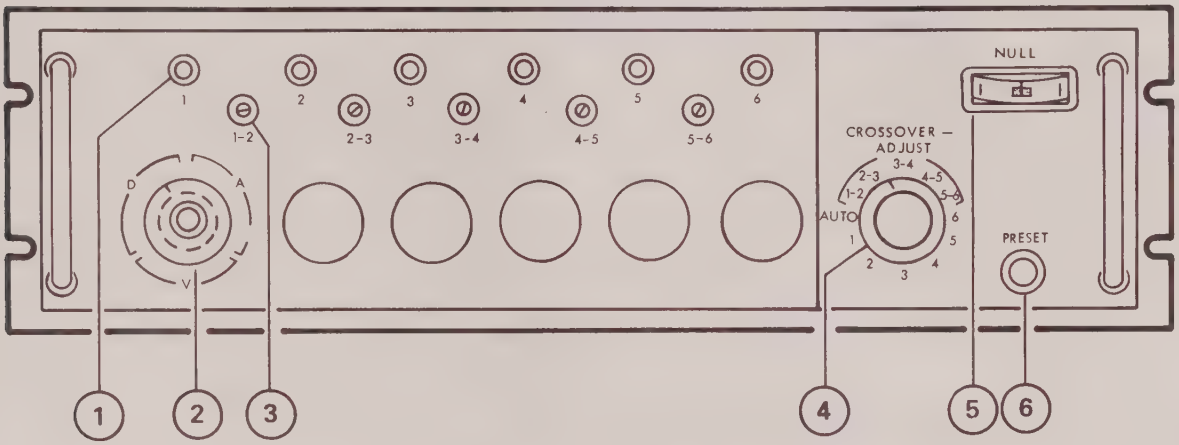


Figure 1-2. Front Panel

(1) A-V-D Indicators (1 through 6)

Light individually to indicate which A-V-D Level (1 through 6) is in operation.

(2) A-V-D Range Switches/LEVEL Controls (1 through 6)

Each A-V-D range switch/LEVEL control performs the following functions:

A-V-D Range Switch

Outer (larger) knob provides selection of the level range of A (acceleration) at 1, 10, 100 or 1000g; V (velocity) at .1, 1, 10 or 100 inches/second; or D (displacement) at .01, .1, 1 or 10 inches peak-to-peak.

LEVEL Controls

Center (smaller) knob varies level of A, V or D over range selected by associated A-V-D switch.

(3) Level Crossover Adjust Potentiometer (1-2, 2-3, 3-4, 4-5, 5-6)

Used during system programming to set the crossover point (frequency) between A-V-D levels 1–6. Fewer than six levels (or five crossovers) can be programmed by turning unused higher number crossover potentiometer (5-6, 4-5, etc.) fully clockwise.

(4) Mode Selector

This multiple purpose switch/control performs the following functions:

AUTO/PRESET (Lower Markings 1 thru 6)

AUTO position, used during normal operation, provides automatic selection of levels 1 through 6 as a function of system excitation frequency. Positions 1 through 6 are used during programming to preset individual level controls for proper outputs as indicated on SD114A front panel DB (A-V-D) meter. However, any position 1 through 6 may be selected as a fixed-level operational mode.

CROSSOVER ADJUST (Upper Markings)

Setting applies outputs of selected levels (1 and 2, 2 and 3, 3 and 4, etc.) to NULL meter circuit during programming of crossover points. (See Level Crossover Adjust Potentiometers described above.)

(5) NULL Meter

Facilitates setting exact crossover point between levels when calibrating and programming the SD117A.

(6) PRESET Indicator

Lights to indicate SD114A and SD117A are in PRESET mode ready for level calibration and programming. OUTPUT control/switch on SD114A is set to PRESET detent (extreme CCW position). A calibration voltage (PRESET INPUT) is applied to all A-V-D LEVEL controls (described above).

1.3 REAR OF CHASSIS FUNCTIONAL DESCRIPTION

Figure 1-3 illustrates the rear of the instrument chassis followed by a brief description of each of the input/output functions.

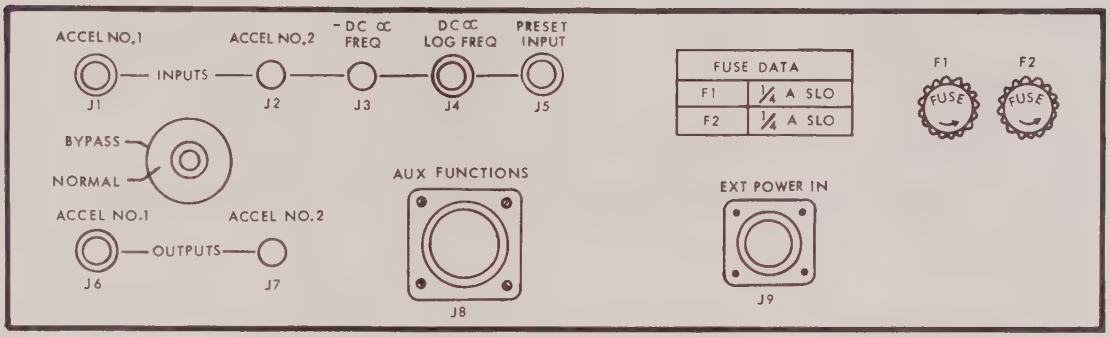


Figure 1-3. Rear of Chassis

BYPASS/NORMAL Switch

BYPASS

ACCEL NO. 1 INPUT is connected directly to ACCEL NO. 1 OUTPUT for application to the SD114A; also, all SD117A interlock circuitry is shunted and lamp circuits are disabled. SD117Ais in standby condition.

NORMAL

ACCEL NO. 1 INPUT is used and processed to provide programmed levels of A, V or D at ACCEL NO. 1 OUTPUT.

INPUTS

ACCEL NO. 1 (J1)

Accepts control accelerometer output signal.

EXT POWER IN (J9)

Accepts operating power supply voltages from SD114A.

ACCEL NO. 2 (J2)

Not used.

-DC ∝ FREQ (J3)

Not used.

DC ∝ FREQ (J4)

Accepts the d-c voltage proportional to log frequency from SD114A; this voltage controls the automatic level switching circuits during a normal swept-frequency operation.

PRESET (J5)

Accepts variable amplitude sine wave signal from SD114A. This signal replaces accelerometer input during calibration and programming procedure and provides for closed-loop-preset of all levels.

OUTPUTS

ACCEL NO. 1 (J6)

Connected to SD114A ACCEL INPUT.

ACCEL NO. 2 (J7)

Not used.

AUX FUNCTIONS (J8)

Provides interconnections to SD114A for interlock circuitry and various intercontrol functions required during preset level calibration and programming.

FUSES

F1 — Contains 3AG type, 1/4A SLO-BLO fuse; fuses +38V d-c input from SD114A.

F2 — Same as F1; fuses -38V d-c input from SD114A.

1.4 SPECIFICATIONS

INPUTS

FREQUENCY RANGE . . . . . 5Hz–5 kHz

ACCEL NO. 1

Sensitivity . . . . . .10 mV (peak)/g (peak)
Impedance . . . . . 80 kΩ

PRESET

(used as calibration signal to preset levels, and to preset smooth crossovers using NULL meter)

Amplitude . . . . . Variable amplitude sine wave from SD114A PRESET OUTPUT

DC ∝ FREQUENCY

(used for crossover switching)

Amplitude . . . . . 0 to 1 Vdc from SD114A

OUTPUTS

ACCEL (connects to Accel Input of SD114A Sweep Oscillator Servo)

Impedance . . . . . .<600Ω

Full Scale Ranges	Accel(g) (5–5,000 Hz)	Velocity (in.s/s) (5–1,000 Hz)	Displ (in. p-p) (5–1,000 Hz)
	1,000	100	10
	100	10	1
	10	1	0.1
	1	0.1	0.01

MISCELLANEOUS

INPUT/OUTPUTS . . . . . .BNC connectors on rear of chassis

POWER . . . . . ±38 Vdc, @ ≈25W, supplied by the SD114A.

DIMENSIONS . . . . . .Height . . . . . .3-1/2" (8,89 cm)
Width (std. panel) . . . . . 19" (48,3 cm)
Depth (w/o connectors) . . . . . 14" (35,6 cm)
Shipping Weight . . . . . 10 lbs (4,53 kg)

SECTION II

OPERATION

2.1 GENERAL

The Model SD117A Automatic Level Programmer was specifically designed for use in a system employing a Model SD114A Sweep Oscillator Servo. If the instrument is purchased as part of a system, refer to the applicable system instruction manual which includes installation and operation instructions for the SD117A. See Figures 1-3 and 1-4 in Section I of this manual for the description and location of all operating controls, indicators and connectors. Review also the block diagram description in Section III.

The following operational check and operating instructions are provided mainly for the user who has purchased the SD117A for integration into an existing system. In this case, Figure 2-1 provides the basic interconnections required between the SD117A and associated SD114A unit. Figure 2-2 provides construction details and parts list for Cable Assemblies 11672-1 and 11672-3.

CAUTIONS

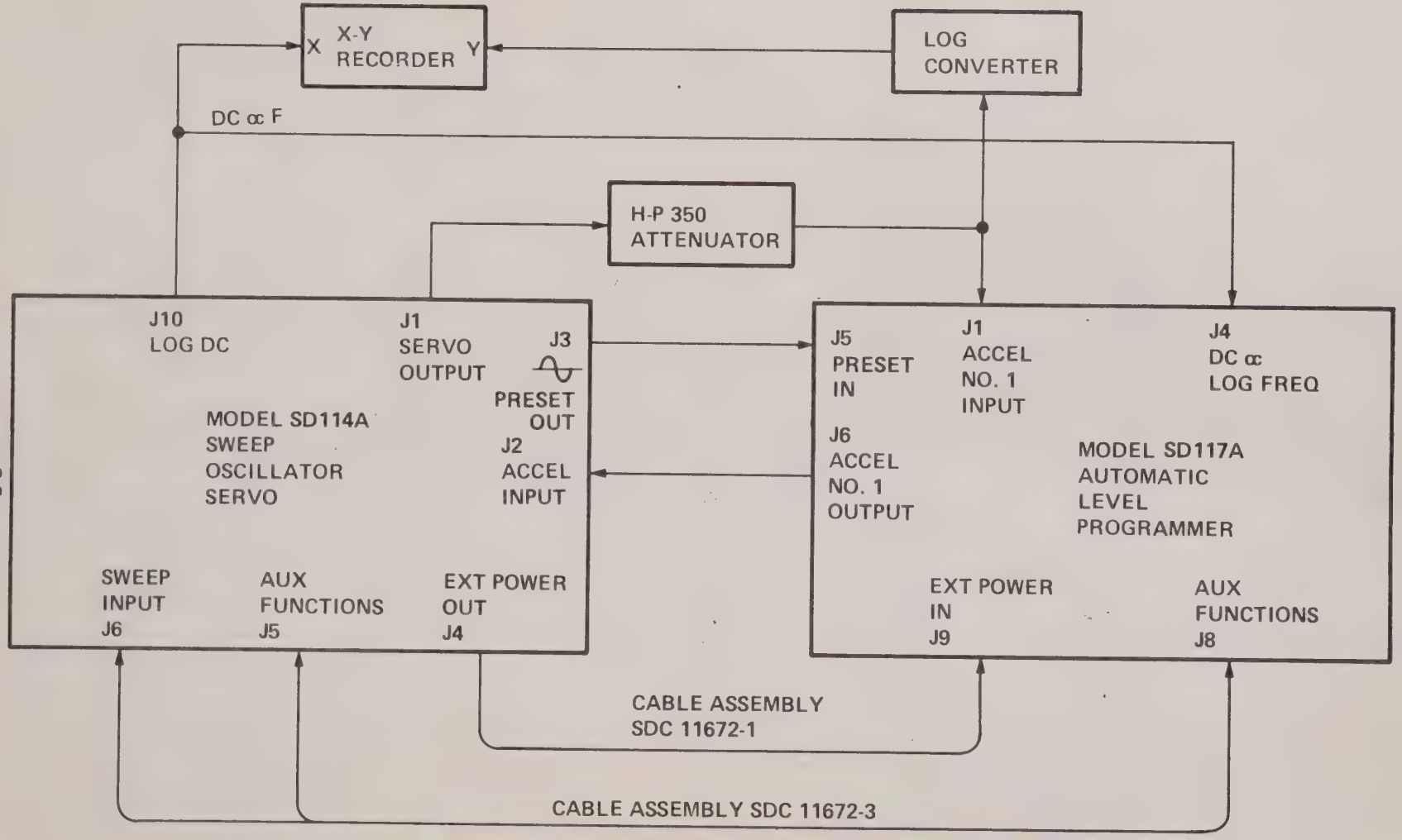
1) The SD117A receives its operating power supply voltages from the SD114A via Cable Assembly SDC 11672-1. The SD114A is powered when its line cord is plugged into the primary power receptacle. When installing the units, facilities should be made to control the input power by means of a master power switch.

2) DISCONNECT SD114A FROM PRIMARY POWER SOURCE BEFORE INTERCONNECTING SD117A.

2.2 OPERATIONAL CHECK

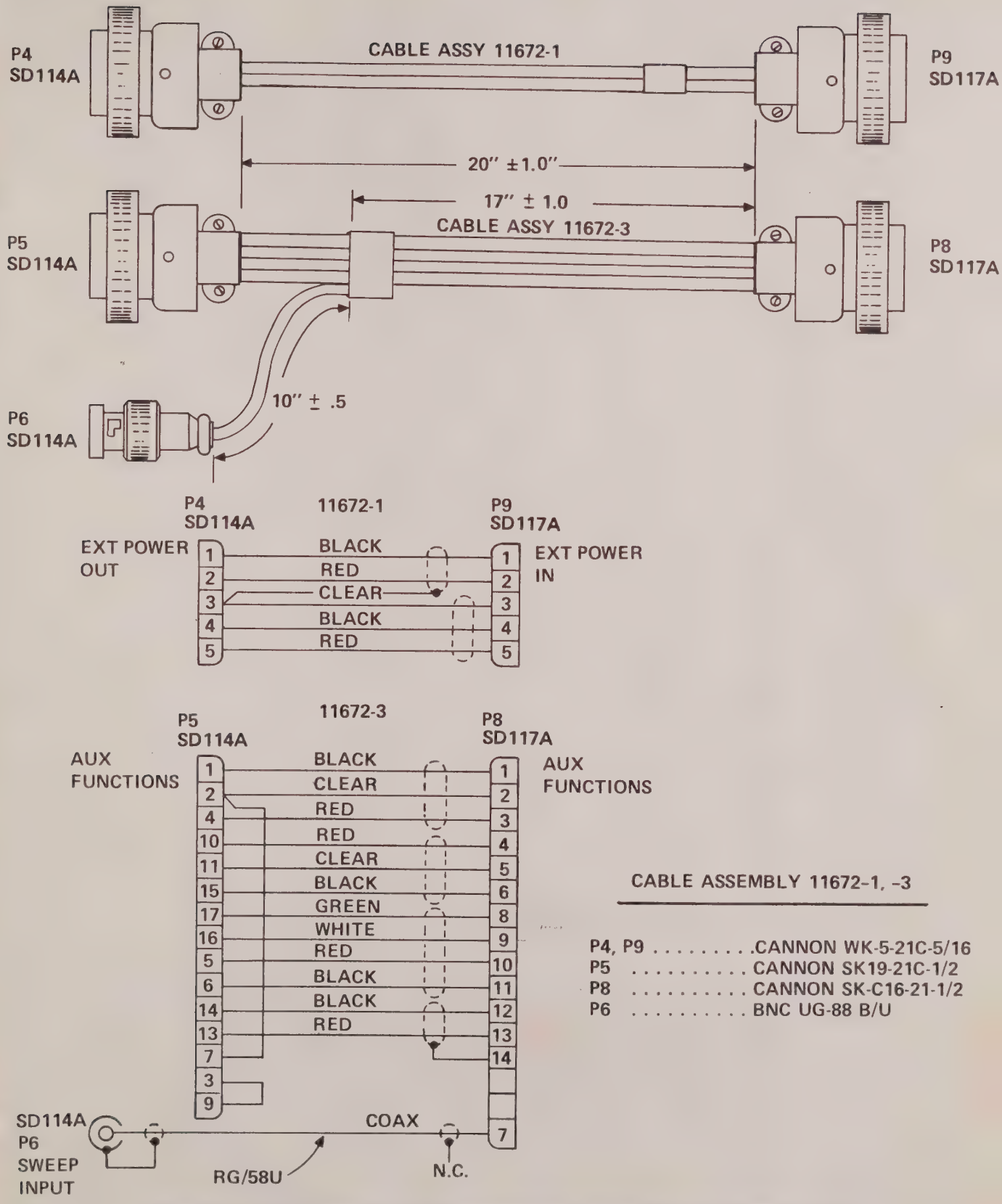
The following operational check may be used to determine that the instrument is functioning properly.

a. Interconnect the SD114A, SD117A, and test equipment as shown in Figure 2-1. Apply power to all instruments and allow at least 1-hour for the SD114A to reach full frequency stability.



CAUTION: DISCONNECT SD114A FROM PRIMARY POWER SOURCE BEFORE INTERCONNECTING THE SD117A.

Figure 2-1. Equipment Setup for Operational Checkout



CABLE ASSEMBLY 11672-1, -3

P4, P9 . . . . . .CANNON WK-5-21C-5/16
P5 . . . . . CANNON SK19-21C-1/2
P8 . . . . . CANNON SK-C16-21-1/2
P6 . . . . . BNC UG-88 B/U

Figure 2-2. SD117A and SD114A Interconnection Cables SDC 11672-1 and 11672-3

b. Set the following controls on the SD117A as indicated:

A-V-D Range	Setting
1	DISPL (IN. P-P), 0.1
2	ACCEL(g), 10
3	ACCEL(g), 100
4	DISPL (IN. P-P), .01
5	VEL (IN./SEC), 10
6	ACCEL(g), 100
Crossover Potentiometer (2-3, 3-4, etc.)	Fully Clockwise
Mode Switch	PRESET 1
BYPASS/NORMAL	NORMAL

c. Set the following controls on the SD114A as indicated:

SWEEP RATE (0—10)	3
Multiplier A	1
Mode Selector	MAN.
FREQ ADJUST	200 Hz (20 on meter in 50—500 Hz decade range)
COMPRESSOR SPEED Control	300 dB/s on COMPR SPEED meter
COMPRESSOR	AUTO
OUTPUT	Full CCW to PRESET detent position
A-V-D Range	ACCEL(g) 1000
ACCEL(g) Range Select	OFF
OPERATE/PRESET	OPERATE/FLAT

NOTE

Before proceeding with step d., allow at least a 1-hour warmup for the SD114A.

d. On SD117A, adjust LEVEL 1 potentiometer for 0.1 in. p-p on SD114A DB (A-V-D) meter (METER READS 10)

e. On SD117A, switch to PRESET 2 and adjust LEVEL 2 potentiometer for 10g on SD114A DB meter. (Meter reads 10.)

f. On SD117A, switch to PRESET 3 and adjust LEVEL 3 potentiometer for 20g on SD114A DB meter. (Meter reads 2.)

g. On SD117A, switch to PRESET 4 and adjust LEVEL 4 potentiometer for 0.00145 in. p-p on SD114A DB meter. (Meter reads 1.45.)

h. On SD117A, switch to PRESET 5 and adjust LEVEL 5 potentiometer for 1.85 in./s on SD114A DB meter. (Meter reads 1.85.)

i. On SD117A, switch to PRESET 6 and adjust LEVEL 6 potentiometer for 22g on SD114A DB meter. (Meter reads 2.2.)

NOTE

In the following steps, when programming a step-change crossover, it is permissible for the SD117A NULL meter and the SD114A DB (A-V-D) meter to go off scale. Only the SD114A frequency meter is used to indicate the desired crossover frequency.

j. On SD117A, set Mode switch to CROSSOVER ADJ 1-2. On SD114A, set mode selector to CROSSOVER FREQ.

k. On SD117A, adjust crossover potentiometer 1-2 for approximately 44 Hz on SD114A FREQUENCY meter.

l. On SD117A, adjust crossover potentiometer 1-2 for a null on NULL meter and then set Mode switch to CROSSOVER ADJ 2-3. This is a step-change crossover; therefore, adjust crossover potentiometer 2-3 for 100 Hz on SD114A frequency meter.

m. On SD117A, set Mode switch to CROSSOVER ADJ 3-4. This is a step-change crossover; therefore, adjust crossover potentiometer 3-4 for 200 Hz on SD114A frequency meter.

n. On SD117A, set Mode switch to CROSSOVER ADJ 4-5. (This is a smooth crossover.) Adjust crossover potentiometer 4-5 for approximately 400 Hz on SD114A frequency meter.

o. On SD117A, adjust crossover potentiometer 4-5 for a null on NULL METER and then set Mode switch to CROSSOVER ADJ 5-6. (This is a smooth crossover.) Adjust crossover potentiometer 5-6 for approximately 735 Hz on SD114A frequency meter.

p. On SD117A, adjust crossover potentiometer 5-6 for a null on NULL meter and then set Mode selector to AUTO.

q. On SD114A, set Mode selector to SINGLE LOG SWEEP and adjust upper and lower frequency limits for 10 Hz and 2,000 Hz respectively.

r. Calibrate recorder to accept program: X-axis, 10—2000 Hz; Y-axis, 1—25g.

s. On SD114A, press RESET DOWN push button and adjust SPEED control for 20 dB/s reading on COMPR SPEED meter.

t. On SD114A, set COMPRESSOR switch to STBY; wait for COMPR LEVEL meter to read below 80 dB before proceeding to the next step.

u. On SD114A, adjust OUTPUT control fully clockwise to 10. Set COMPRESSOR switch to AUTO, press SWEEP UP push button and observe recorded program.

The program should be as shown in the typical test level profile on Page 1-2 in Section 1. If any of the smooth crossover points are irregular, repeat the preceding steps that are applicable to that portion of the program.

CAUTION

Do not move the LEVEL potentiometers. If one is moved, that level will have to be reprogrammed, including the adjacent crossover adjustments.

2.3 OPERATION

NOTE

Before actual operation in a shaker system, it is recommended that the operator become familiar with programming the SD117A by performing the OPERATIONAL CHECK of paragraph 2.2. For this check, the SD117A and SD114A are connected as shown in Figure 2-1, with an H-P 350 substituted for the shaker system.

To set up the SD117A for normal operation, proceed as follows:

a. Outline the operational program by listing the desired six A-V-D levels, crossover frequencies, etc. (Roughly compute the smooth crossover frequencies.) The usable A, V and D parameters are included within the heavy outlines on the graphs of Figures 2-3, 2-4 and 2-5.

b. On SD114A, set OUTPUT control to PRESET (fully CCW to switch detent position).

c. Adjust shaker system MASTER GAIN to OFF.

d. Apply power to the system and allow at least 1-hour warmup for the SD114A Sweep Oscillator Servo.

e. On SD117A, set the six front-panel A-V-D range switches to the proper settings in accordance with the program.

*

NOTE

The A-V-D Level switch markings indicate full-scale range. For example, to program displacement from 0.11 in. p-p to 1 in. p-p, set switch to DISPL (IN. P-P) position 1.

f. On SD117A, adjust crossover potentiometers 2-3, 3-4, etc., fully clockwise and set Mode switch to 1.

g. On SD117A rear chassis, ensure BYPASS/NORMAL switch is set to NORMAL.

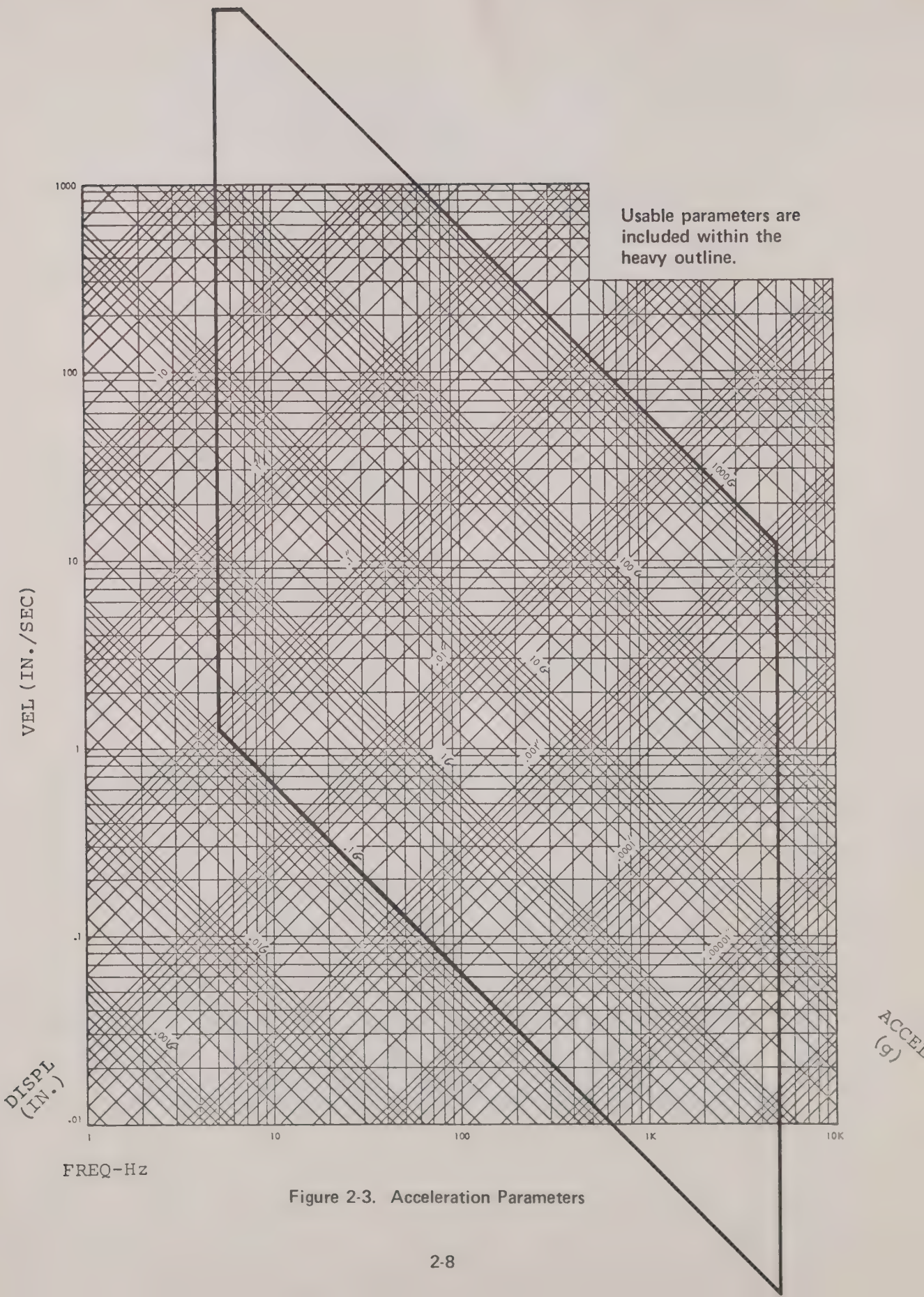


Figure 2-3. Acceleration Parameters

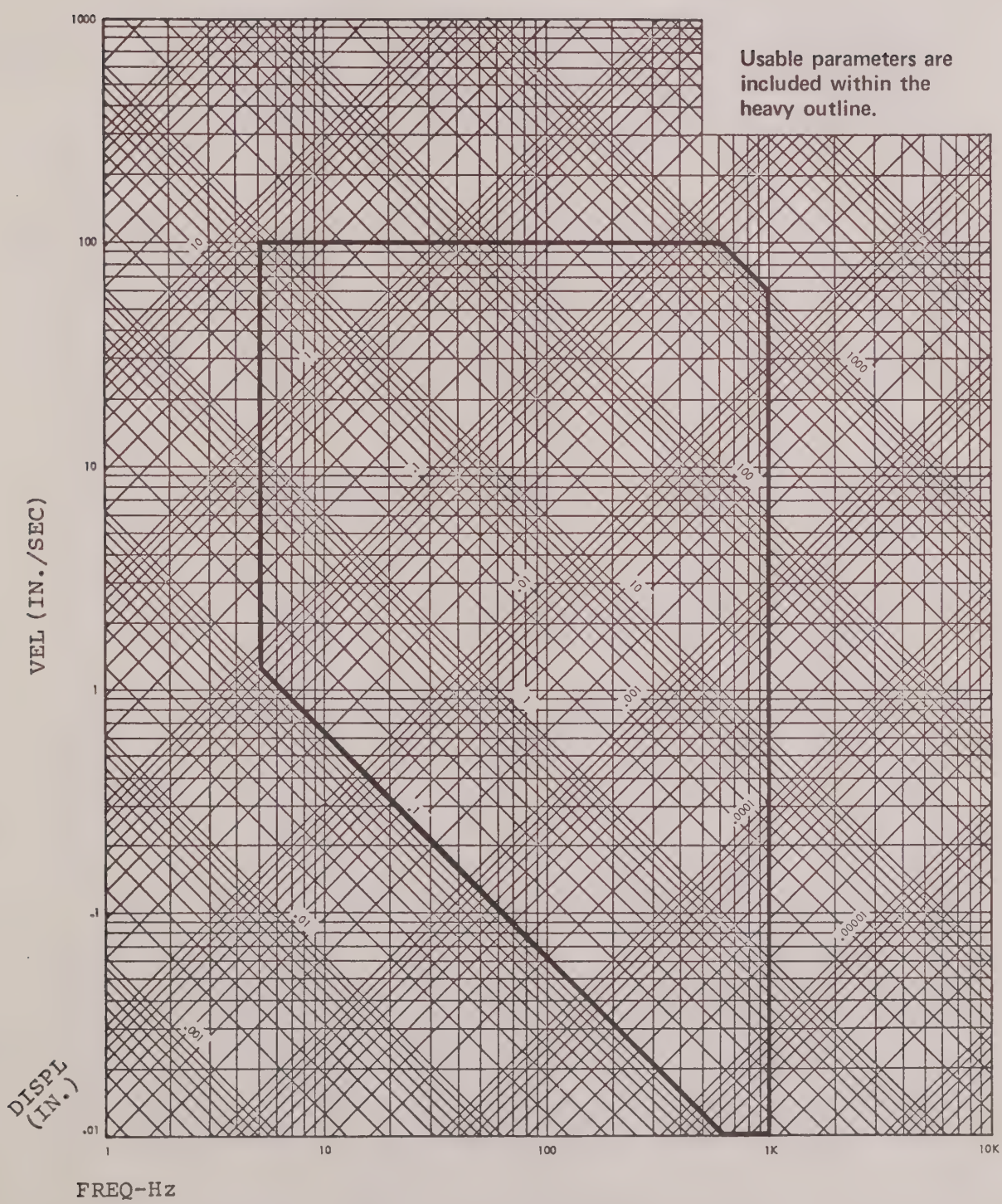


Figure 2-4. Velocity Parameters

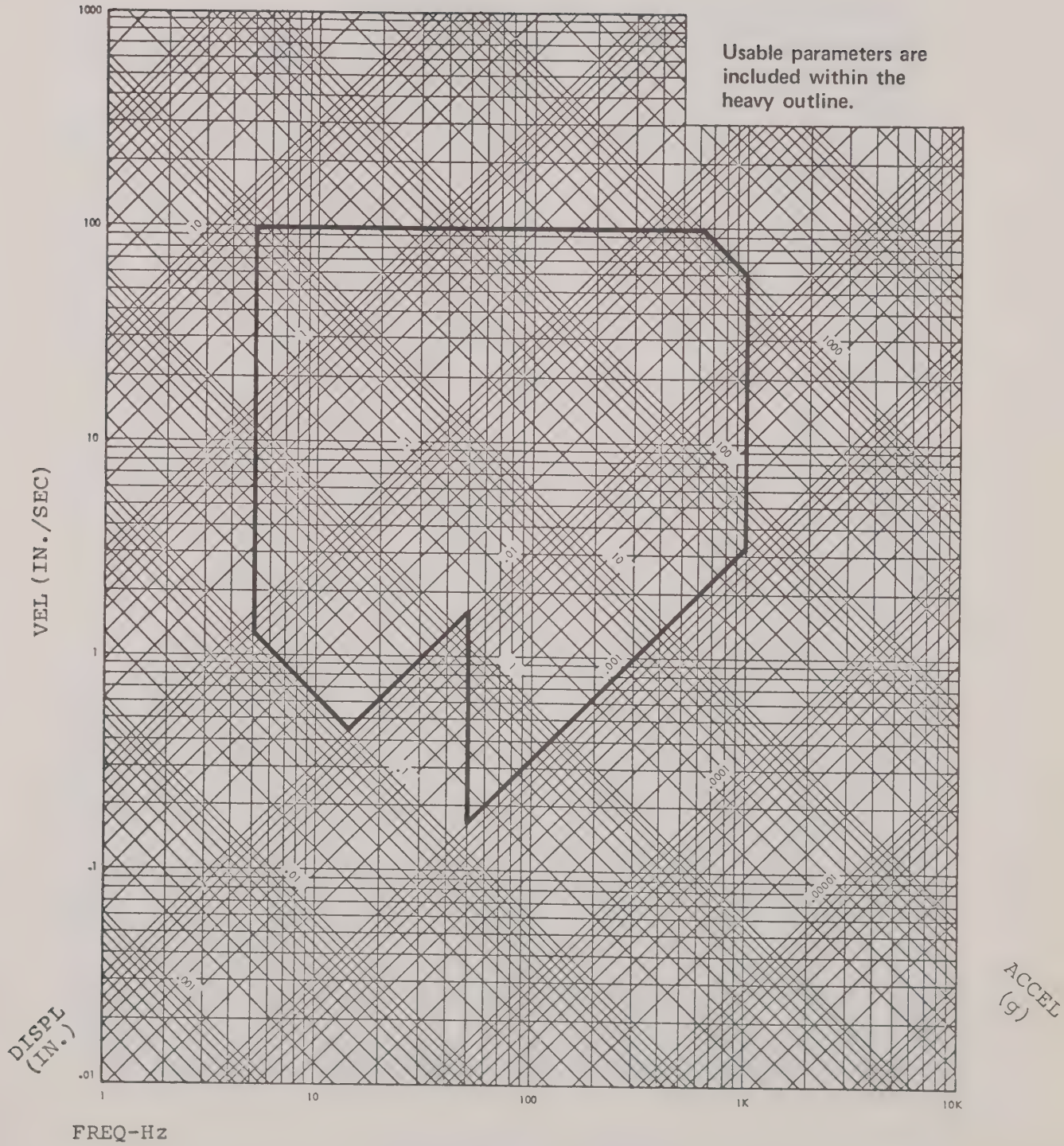


Figure 2-5. Displacement Parameters

h. Set the following controls of the SD114A as indicated:

SWEEP RATE (0—10) and Multiplier A	As required by program
MODE Selector	MAN.
FREQ ADJUST	200 Hz (20 on meter in 50—500 decade range)
COMPRESSOR	AUTO
A-V-D Range	ACCEL(g) 1000
ACCEL(g) Range	OFF
OPERATE/PRESET	OPERATE/FLAT

NOTES

1) Before proceeding with step i., ensure that the SD114A has warmed up for at least 1-hour.

2) If less than six levels are programmed, always start with Level 1. The unused higher number levels will be skipped as a function of the crossover adjustments made in step j.

i. Preset the desired A, V or D parameters for each level (1 through 6) as follows: Sequentially set the Mode selector to PRESET positions 1 through 6. At each setting adjust the corresponding LEVEL control for the desired parameter of A, V or D as read on the SD114A DB meter.

NOTE

In the following step, when programming a step-change crossover, it is permissible for the SD117A NULL meter and the SD114A DB (A-V-D) meter to go off scale. Only the SD114A frequency meter is used to indicate the desired crossover frequency.

j. Preset the crossover potentiometers in sequence 1-2, 2-3, 3-4, etc., as follows:

On the SD114A, set the Mode selector to CROSSOVER FREQ and then sequentially set the SD117A Mode switch to CROSSOVER ADJ positions 1-2, 2-3, etc. At each setting, adjust the corresponding crossover potentiometer for the proper crossover frequency as read on the SD114A frequency meter (step-change crossover), or for a null on the SD117A NULL meter. (Review steps j. through s. of paragraph 2.2.) If less than six levels (five crossovers) are programmed, adjust the unused higher number crossover potentiometers fully clockwise.

CAUTION

Do not move LEVEL potentiometers. If one is moved, that Level will have to be reprogrammed, including the adjacent crossover adjustments.

The multi-level program is now preset in the SD117A. Normal automatic operation is initiated as follows:

k. On SD117A, set Mode switch to AUTO.

l. On SD114A, set Mode selector to SINGLE LOG SWEEP and set the upper and lower frequency limits as required for the program.

m. If a recorder is used, calibrate it to accept the program.

n. On SD114A, press RESET DOWN push button and adjust SPEED control for desired indication on COMPR SPEED meter.

o. On SD114A, set COMPRESSOR switch to STBY; wait for COMPR LEVEL meter to read below 80 dB before proceeding to the next step.

p. On SD114A, adjust OUTPUT control fully clockwise to 10, and set COMPRESSOR switch to AUTO.

q. Bring rest of system "on-the-air".

r. On SD114A, press SWEEP UP push button, and program will run automatically.

Any one of the six preset levels can be separately selected by setting the SD117A Mode switch to the level desired (1, 2, 3 --- or 6).

SECTION III

CONCEPT AND THEORY OF OPERATION

3.1 CONCEPT OF OPERATION

The Model SD117A ALP operates as an integral part of a servo loop in a sine servo shaker to provide programmed control of up to six preset levels of acceleration (A), velocity (V) or displacement (D). The output signal from a single accelerometer is routed through the SD117A to the SD114A. Using electronic integration, the SD114A produces a-c signals proportional to velocity and displacement. The buffered acceleration, velocity and displacement signals are returned to the SD117A for level programming and crossover switching.

The SD117A employs solid-state switching circuitry controlled by a d-c voltage proportional to the operating frequency (from the SD114A), to provide automatic and smooth crossover switching between levels. The selected monitor and servo outputs are then routed to the SD114A servo monitor section for display on the front-panel DB (A-V-D) meter and for compression control of the SERVO OUTPUT.

3.2 BLOCK DIAGRAM DESCRIPTION

The following paragraphs describe in sequence the operation of the SD117A in each of its normal operational modes. It is assumed that the SD117A is operating in a sine servo shaker system and is connected to an SD114A Sweep Oscillator Servo as prescribed in Section II of this manual.

First, the SD117A is programmed by presetting each of the six levels and frequency crossovers. Then, with the mode switch set in the AUTO position, the six programmed levels are automatically selected in sequence (1–6) as a function of the system excitation frequency.

3.2.1 Preset Level Adjustment

The monitor and servo outputs are calibrated to the SD114A at the desired level of operation for each of the six LEVELS, using the corresponding LEVEL potentiometers. For each LEVEL, the desired program level (monitor output) is set up as read on the SD114A DB (A-V-D) meter.

The SD117A mode switch S7 is first set to 1. (See Figure 3-1.) The SD114A OUTPUT control is set to the extreme CCW position (PRESET detent). In this condition, approximately 24 Vdc from the SD114A is routed through AUX FUNCTIONS connector J8 to relay drivers (A5Q13 and -14) which energize both relays K1 and K2. With relays K1 and K2 energized, a calibration signal from the PRESET INPUT (J5) is applied to each LEVEL potentiometer (R1–R6).

Each LEVEL potentiometer provides two outputs: One output is the same as its input voltage level; the second output is determined by the setting of the LEVEL potentiometer. These pairs of signals are applied to the transfer switching circuitry at the inputs of the monitor and servo FET buffers.

* The transfer switches are controlled by the crossover switching circuitry. With the SD117A mode switch set to 1, only junction points "A" & "B" and "N" & "R" are high impedance, allowing the LEVEL 1 signals to pass through; all other junction points are grounded by their associated FET switches.

A diode matrix at the inputs to all crossover switch FET's allows only one of the six level pairs to be selected at any time; also, by means of the mode switch (S7E), a fixed enabling voltage is applied only to the selected crossover switching amplifier. The output of the monitor FET buffer is fed through a unity-gain dynamic filter and then routed through J8 to the SD114A meter amplifier (servo section). The output of the servo FET buffer is fed through a unity-gain buffer and then routed through J8 to the SD114A for servo control.

In sequence, the SD117A mode switch is set to positions 2 through 6, and each level is preset as described above for Level 1. After all levels are calibrated to the SD114A, the desired level crossover points are programmed as described in the following paragraphs.

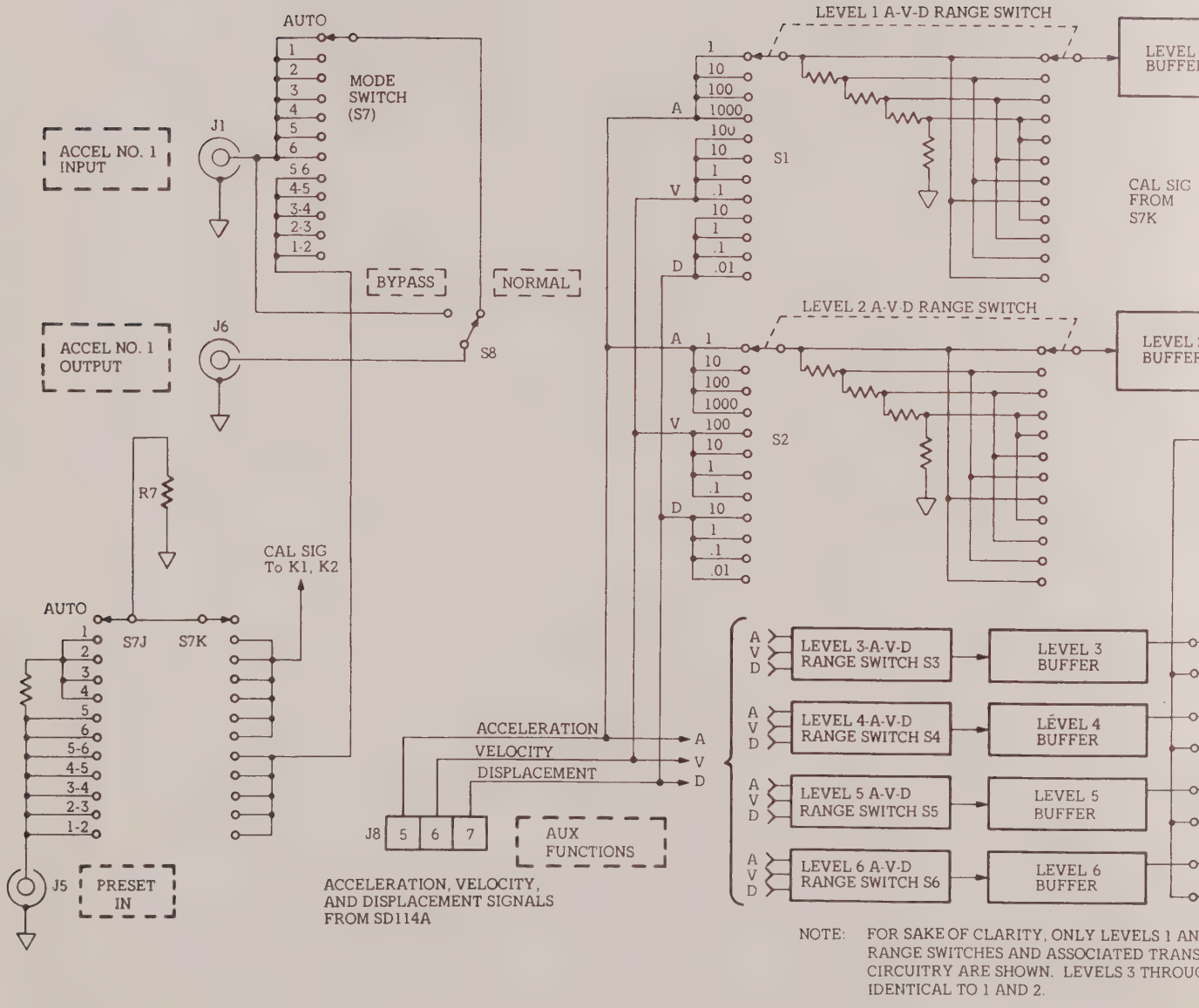
3.2.2 CROSSOVER Adjustments

The SD114A output frequency is controlled by a d-c voltage from the SD117A. See Figure 3-2, and note that the SD114A is in a closed loop with the SD117A crossover adjust circuitry. The DC $\propto$ LOG FREQ from the SD114A is summed with a voltage adjusted by crossover adjust potentiometer 1-2 (R8). The difference voltage at "E" is integrated and used to control the SD114A VCO(voltage-controlled oscillator). The VCO is caused to change frequency until its DC $\propto$ LOG FREQ output equals the voltage at the arm of R8. Note that the potential at summing junction "S" is also at zero, thereby holding off the level 2 switch driver.

If the program requires a stepped change between two levels at a specific frequency, the crossover adjust potentiometer is varied until the SD114A output equals that frequency. If a smooth crossover is desired, the crossover adjust potentiometer is varied until the SD117A NULL meter indicates a null. (The null indication circuitry is described later.)

During normal automatic operation the loop is open. The SD114A sweeps up, and when the DC $\propto$ LOG FREQ exceeds the preset voltage, level-2 select switch driver is actuated causing the transfer switching circuitry to select Level 2. Each of the five crossover operations occurs in a similar manner as the frequency sweeps upward from below the lowest crossover frequency to above the highest.

The NULL meter and associated detectors facilitate programming a smooth crossover between any two sequential levels. Also, in the CROSSOVER ADJUST mode, relays K1 and K2 are de-energized, and a PRESET INPUT applied at J5 from the SD114A replaces the acceleration signal. The A-V-D signals are supplied from the SD114A, and all six preset levels of A, V or D are available for selection.



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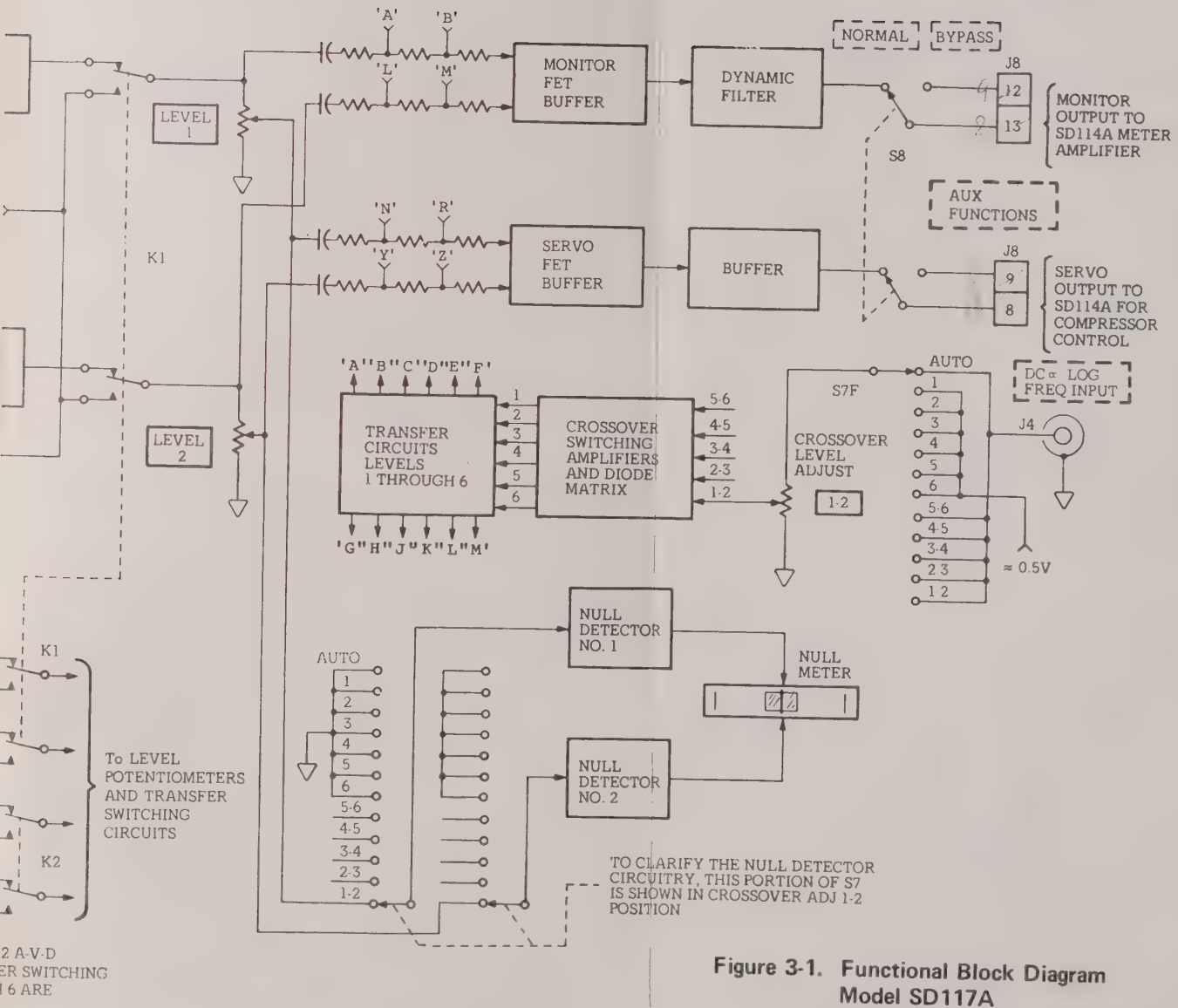


2 A-V-D
ER SWITCHING
1 6 ARE

Figure 3-1. Functional Block Diagram Model SD117A Automatic Level Programmer

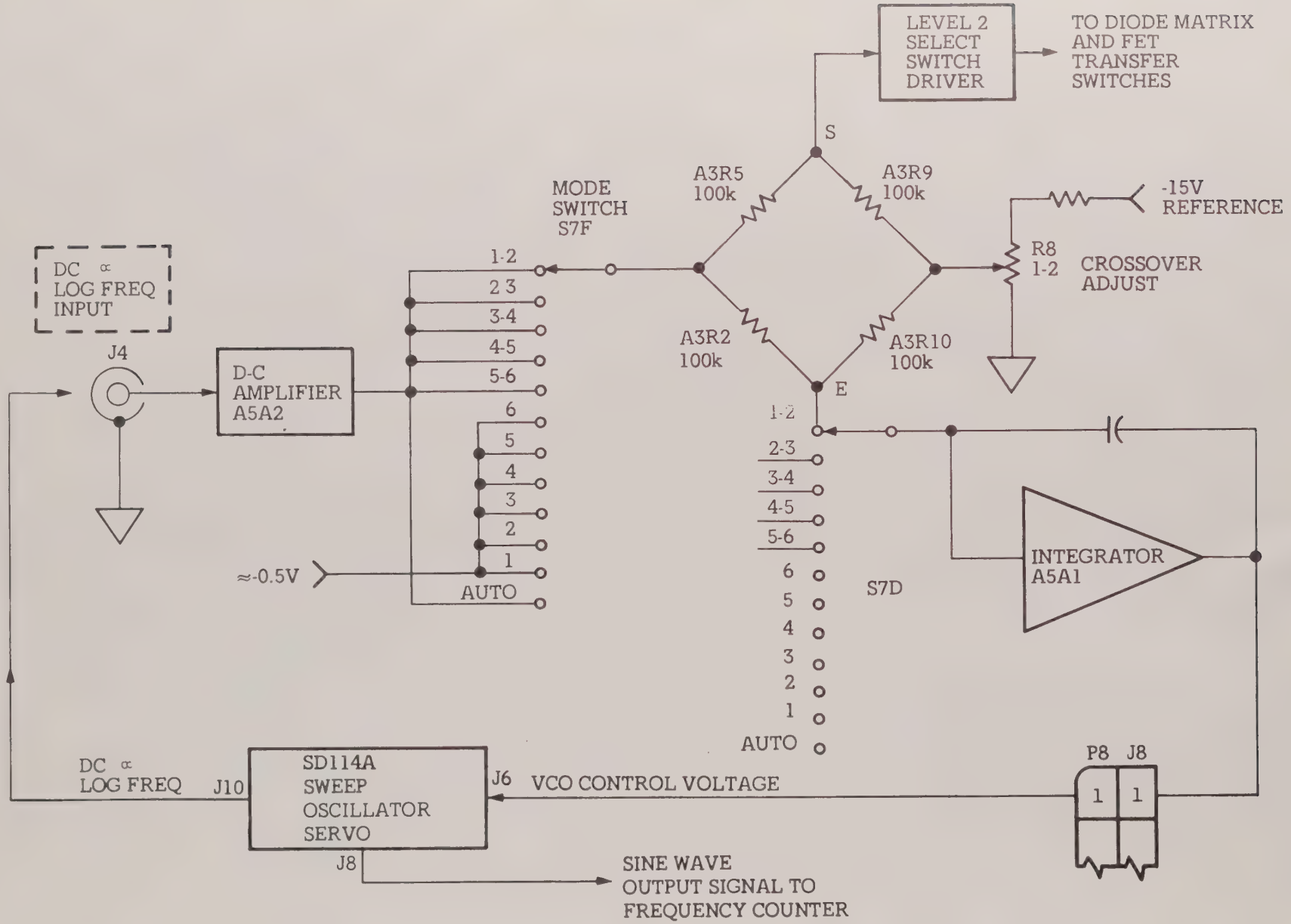


Figure 3-2. Functional Block Diagram of CROSSOVER ADJUST Mode Circuitry

It is recommended that the crossover frequency be roughly calculated; then the crossover adjust potentiometer is adjusted for that frequency on the SD114A.

See Figure 3-1, and note that the preset control signals from the two levels (Levels 1 and 2) being programmed are applied to the null detectors. The detectors are identical with one exception; i.e., a gain calibration control in null detector No. 2 facilitates gain normalization. Now refer to the typical test level profile and associated chart shown in Section I, paragraph 1.1. The approximate frequency for a smooth crossover between Levels 1 and 2 is 44 Hz. Crossover adjust potentiometer 1-2 is adjusted for ≈44 Hz on the SD114A and then crossover adjust potentiometer 1-2 is carefully adjusted for a null on the NULL meter. A null indicates that the output amplitudes of Level 1 and Level 2 are equal at the adjusted crossover frequency.

3.2.3 AUTO Mode

This is the normal operating mode of the SD117A. After all Levels and crossover points have been programmed, the SD117A Mode switch is set to AUTO. The SD114A upper and lower sweep oscillator frequency limits are preset, and the servo section is brought "on-the-air". (Refer to the SD114A Instruction Manual.) The program is then run by an upsweep from the SD114A.

As shown in Figure 3-1, the A, V and D signals are applied to each A-V-D Range Switch. Each switch utilizes a single attenuation network to provide four calibrated amplitudes of the selected A, V or D signal. The output of each A-V-D Range Switch is buffered and routed through the normally closed contacts of relay K1 (or K2) to the LEVEL controls. The subsequent transfer switching and crossover switching circuitry operates as described in the CROSSOVER ADJUST mode (paragraph 3.2.2).

SECTION IV

CALIBRATION AND MAINTENANCE

4.1 GENERAL

Before calibration is attempted, the technician is advised to study Sections II and III of this manual and familiarize himself with the front panel and rear chassis diagrams in Section I.

Top and bottom chassis views, Figures 4-1 and 4-2, are provided with reference designations of pertinent components. Schematic and component layout drawings are at the end of the manual.

All parts and test points mounted on circuit cards are designated by card location and reference number. For example, resistor R9 on circuit card A1 is referred to as A1R9.

If need for calibration is in doubt, perform the operational checks in paragraph 2.2, Section II, of this manual.

4.2 CALIBRATION PROCEDURE

To ensure proper calibration it is important that the following steps be performed in their entirety and in the given sequence.

Table 4-1 lists the test equipment required. Test equipment having equal or better operational characteristics may be substituted.

Table 4-1. Test Equipment Required

Name	Model No.	Manufacturer
Attenuator	350D	Hewlett-Packard
Digital Voltmeter	3440A	Hewlett-Packard
Frequency Counter	5223L	Hewlett-Packard
Oscilloscope	561A1	Tektronix
Time Base Plug-In	Type 67	Tektronix
Preamplifier Plug-In	Type B	Tektronix
X-Y Recorder	135A	Moseley
RMS Voltmeter	3400	Hewlett-Packard

In addition to the above mentioned test equipment, calibration of the SD117A Automatic Level Programmer requires the use of a Spectral Dynamics model SD114A Sweep Oscillator Servo.

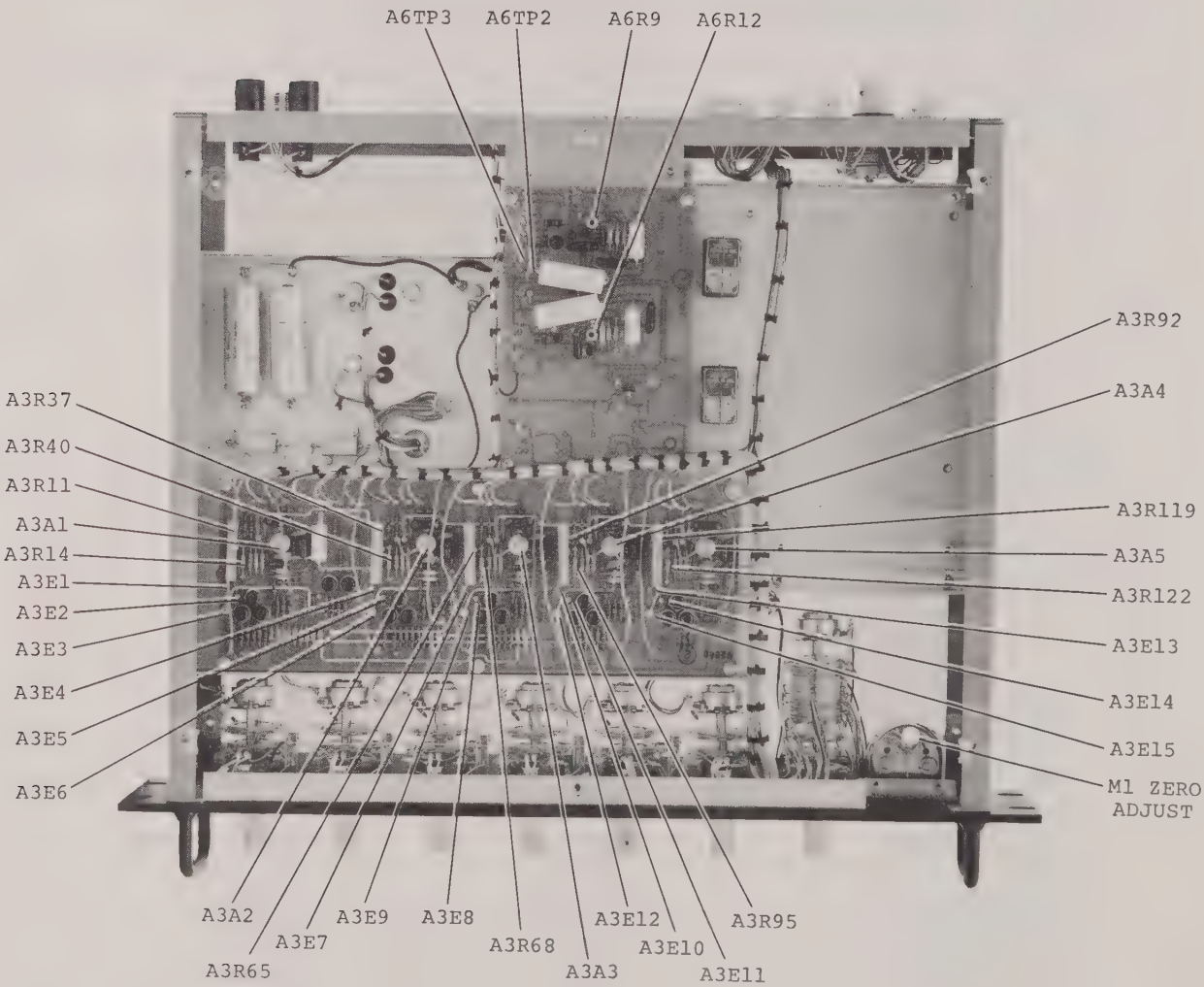


Figure 4-1. Chassis Top View

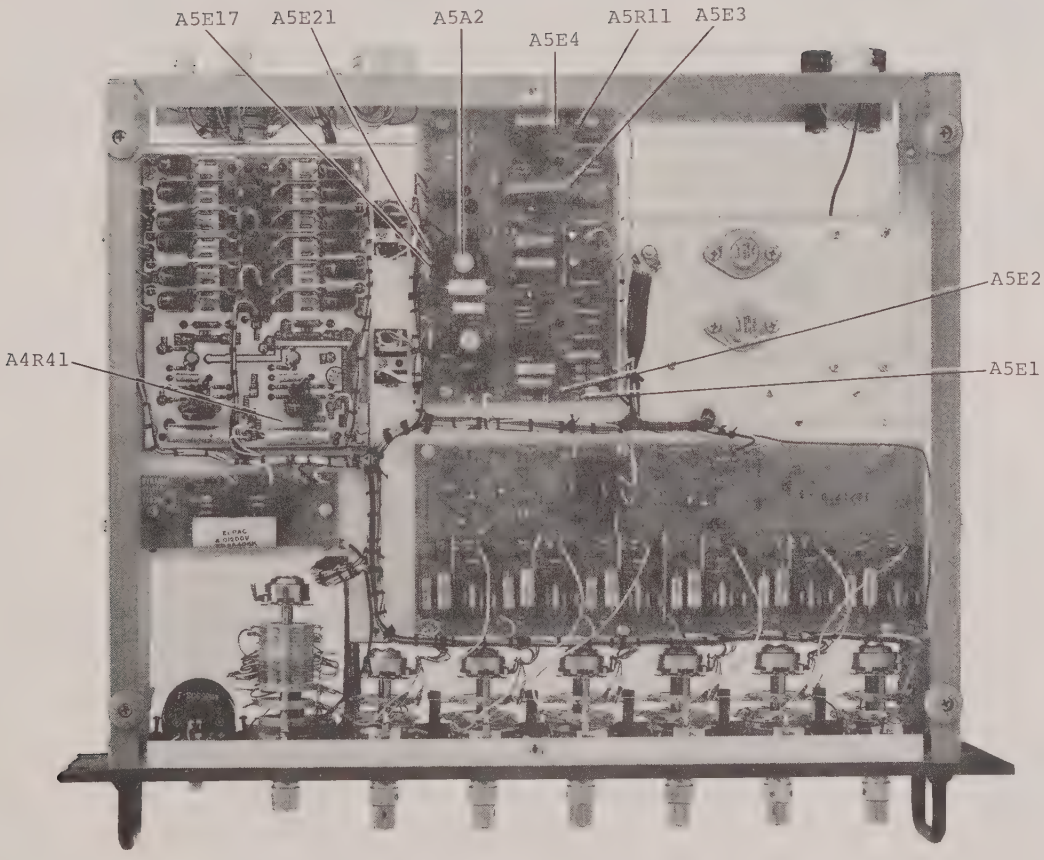


Figure 4-2. Chassis Bottom View

4.2.1 Preliminary – Power Off

a. Remove top and bottom covers.

b. Mechanically adjust NULL meter for centerline position in the green area. A small paper sticker covers the hole through which this adjustment is made.

c. Check for proper fuse value as indicated in FUSE DATA chart on rear of chassis.

d. Make external connections to the SD117A as shown in Figure 2-1, Section II. Refer to Figure 2-2 for construction details of Interconnection Cables SDC11672-1 and 11672-3.

e. Connect SD114A power cord to primary power source. Turn BYPASS/NORMAL switch to NORMAL, and allow a 15-minute warmup (one hour for the SD114A). There is no power indicator lamp but one of the A-V-D indicator lamps should glow, indicating that power is on.

4.2.2 Power Supply

a. Connect a DVM to A6TP3. Adjust A6R12 for −15.00V (−14.99 to −15.01V).

b. Connect oscilloscope to A6TP3. Ripple should be less than 2 mV p-p.

c. Connect a DVM to A6TP2. Adjust A6R9 for +15.00V (14.99 to 15.01).

d. Connect oscilloscope to A6TP2. Ripple should be less than 2 mV p-p.

4.2.3 Voltage Follower Check

a. Set the frequency of the SD114A between 400 and 600 Hz. Disconnect DVM ground link for differential input. Measure voltage between A5E17 and A5E21; if it is over 8 mV, replace A5A2.

4.2.4 Crossover Switching/Hysteresis Check

NOTES

1) It is important that the following steps a. through j. be read through before calibration of crossovers is attempted.

2) Each time power is removed for the purpose of soldering a jumper, or changing a resistor or I.C., wait several minutes after power is again applied before making adjustments.

a. On SD114A, set Mode Selector to CROSSOVER FREQUENCY position.

b. On SD117A, set crossovers 2-3, 3-4, 4-5 and 5-6 between 3 kHz and 5 kHz.

c. On SD117A, adjust crossover 1-2 between 998 and 1002 Hz.

d. On SD114A, switch Mode Selector to the MAN. position.

e. While observing the Level 1 and 2 indicator lamps on the SD117A, SLOWLY up sweep the frequency of the SD114A through 1 kHz. The Level 2 indicator lamp should light between 995 and 1005 Hz. Before making any adjustment, note the frequency at which it does light and SLOWLY down sweep the SD114A through 1 kHz and note that the Level 1 indicator lamp lights at the frequency previously noted, ±30 Hz. If crossover did not occur between 995 and 1005 Hz while sweeping upwards, proceed with the following step f. If crossover was correct, go to step h.

f. Adjust A3R11 (ZERO ADJUST) for a crossover between 995 and 1005 Hz. If A3R11 has insufficient range, remove the jumper between A3E2 and A3E3 (or E1) and connect it between A3E2 and A3E1 (or E2 if already on E1). Then readjust A3R11 for a crossover between 995 and 1005 Hz. See Note 2) above.

If crossover cannot be adjusted properly with the jumper in either position, do step g.; otherwise continue with step h.

g. Select a value for A3R14 (Factory adjust. Resistor must be one percent or better) that will allow proper adjustment in step f. If the selected value for A3R14 falls below 50k ohms, replace A3A1. After this step g. is completed, begin again with step e. See Note 2) above.

h. On SD114A, switch the Mode Selector to CROSSOVER FREQUENCY.

i. On SD117A, adjust crossover 1-2 between 400 and 600 Hz.

j. Using the appropriate ±15V jumpers, associated ZERO ADJ potentiometers and factory adjust resistors as tabulated below, perform steps c. through j., as necessary, for crossovers 2-3, 3-4, 4-5 and 5-6.

Table 4-2. Crossover Adjustment Components

Crossover	Zero Adjust	Jumper Terminals	Factory Adjust	I.C.
1-2	A3R11	A3E2 to A3E3 or 1	A3R14	A3A1
2-3	A3R37	A3E5 to A3E6 or 4	A3R40	A3A2
3-4	A3R65	A3E8 to A3E9 or 7	A3R68	A3A3
4-5	A3R92	A3E11 to A3E12 or 10	A3R95	A3A4
5-6	A3R119	A3E14 to A3E15 or 13	A3R122	A3A5

4.2.5 Null Detector Gain

a. Remove jumpers between A5E1 and A5E2 and between A5E3 and A5E4.

b. Jumper A5E2 to A5E4. Connect an RMS voltmeter and a signal generator to A5E2 and A5E4. Adjust A5R11 for a centerline indication on the NULL meter.

c. Install permanent jumpers between A5E1 and A5E2 and between A5E3 and A5E4.

4.2.6 Gain Normalization

a. On the SD117A, set the NORM/BYPASS switch in the BYPASS position; connect the RMS meter to ACCEL NO. 1 INPUT; set all A-V-D Range switches in the 1000g position and the Mode switch in the 1 position.

b. On the SD114A, select A-V-D ACCEL(g) range of 1000g; set the COMPRESSOR switch to OFF and manually adjust the oscillator frequency for 200 Hz.

c. Adjust the OUTPUT control on the SD114A for an indication on the RMS Meter of 7.07 Vrms, ±70 mV; note the front panel A-V-D/DB meter indication on the SD114A which should be approximately full scale.

d. Switch the NORM/BYPASS switch on the SD117A to the NORMAL position and again adjust the OUTPUT control on the SD114A for an indication on the RMS Meter of 7.07 Vrms, ±70 mV.

*→ e. Adjust A4R41 for the same indication on the A-V-D/DB meter of the SD114A as that noted in the preceding step c. (≈full scale).

4.2.7 Operational Check

a. Disconnect power cord from primary power source. Visually inspect the SD117A, and replace top and bottom covers.

b. Reconnect power and place instrument in service. To ensure proper calibration and overall performance, complete the operational checkout presented in paragraph 2.2, Section II, of this manual.

4.3 PARTS REPLACEMENT

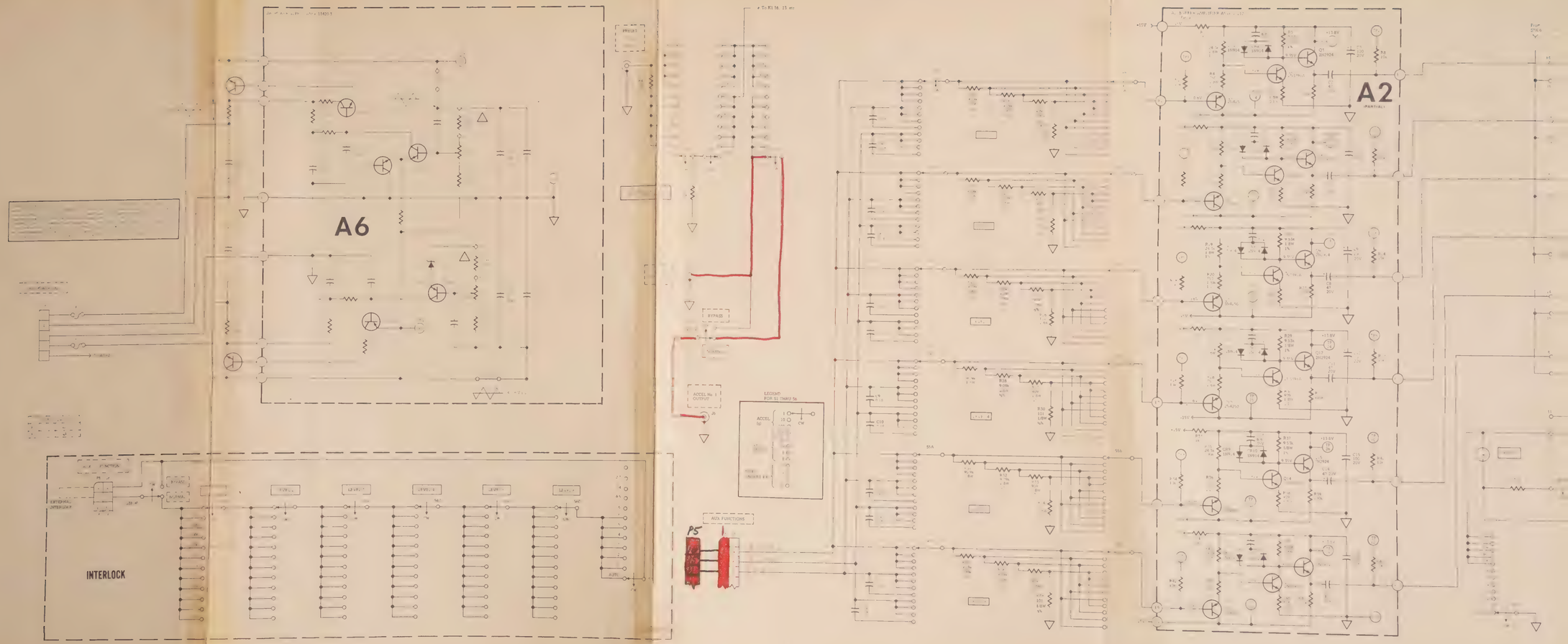
Except for some special SDC specification-controlled parts listed in Table 4-3, which must be ordered from Spectral Dynamics Corporation, standard electronic parts have been used throughout the instrument. Spectral Dynamics Corporation maintains a complete stock of all parts and complete printed circuit card assemblies used in the instrument.

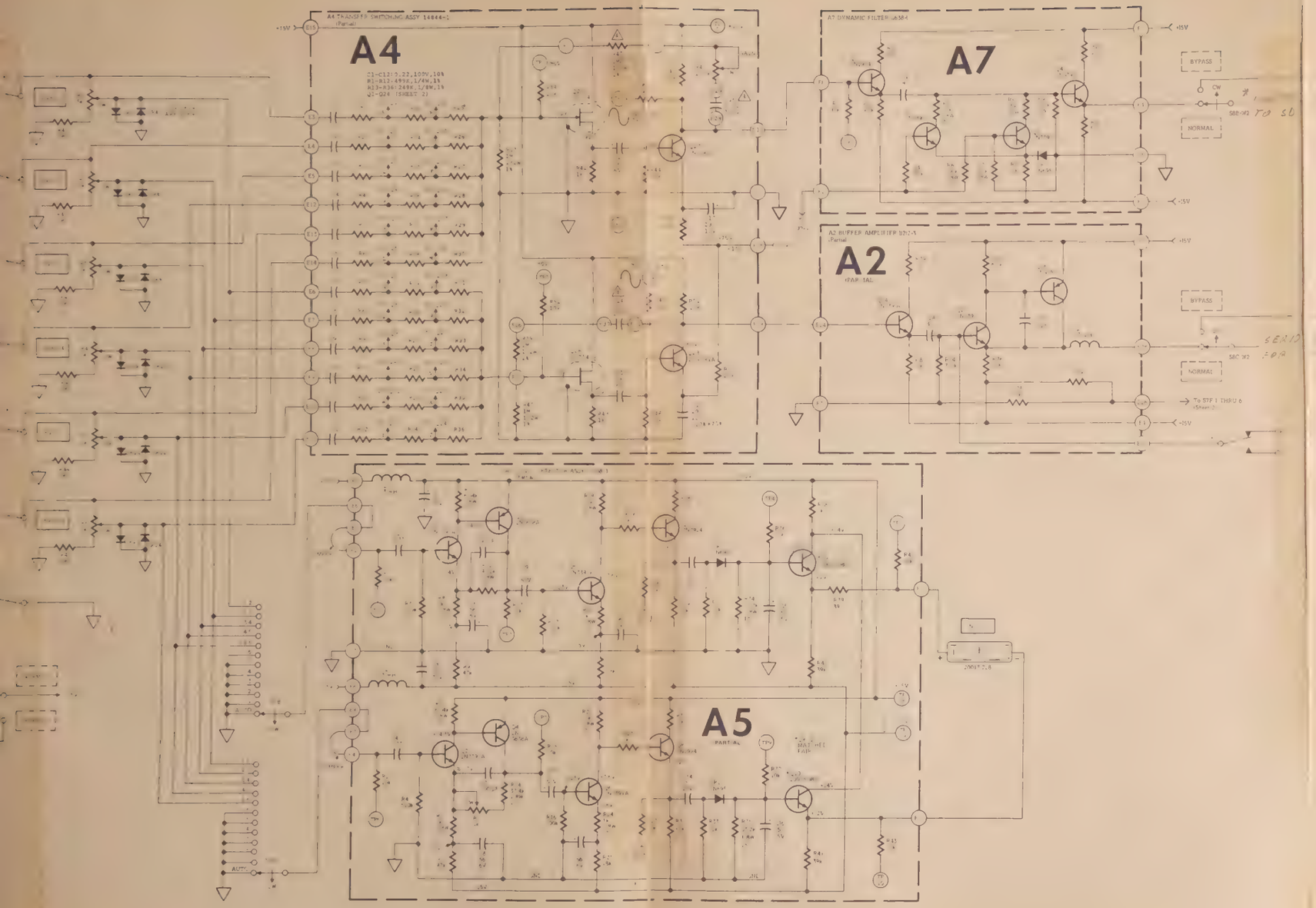
When ordering a replacement part or assembly, be sure to include the reference designation, the part number or manufacturer's designation, and a complete description; include also the instrument name, model number, and serial number.

Table 4-3. Special Replaceable Parts List

Reference Designator	Description	Part Number Mfr. Designation
A2	Buffer Amplifier Assembly	11212-3
A3	Crossover Switching Assembly	11216-1
*→ A4	Transfer Switching Assembly	14844-1
A5	Null Detector Assembly	11208-3
A6	Power Supply Assembly	11420-3
A7	Dynamic Filter	11638-1
DS1—DS6	Lamp, A-V-D Indicator	CF03-WTS-2102
DS7	Lamp, PRESET Indicator	CF03-YTS-2101
	Knob, BYPASS/NORMAL	20013-175
	Knob, A-V-D Range (Large)	20013-176
	Knob, Level Control (Small)	20013-177
	Knob, Mode Selector	20013-175
M1	Meter, NULL	20013-228
P8	Connector	SK-C16-21C-1/2
P9	Connector	WK-5-21C-5/16
S1—S6	Switch, A-V-D Range	20013-201
S7	Switch, Mode	20013-363
S8	Switch, BYPASS/NORMAL	20013-229

*Revised (2-17-72)


A6
A2
INTERLOCK
BYPASS
ACCEL No. 1 OUTPUT
LEGEND FOR S1 THRU S6
ACCEL
CW
AUX FUNCTIONS
P5



REVISIONS						
			DESCRIPTION			
A		011	RELEASED			
B	185	011	Deleted J2 J7 & connections therefrom to SB			
C	834	028	Changed A4R32 from 953h to 909h Fact. Adj A4R47 from 100h to 250h, deleted spare pins 17, 18 and 19 of J6 and P6	G C 8-70		
D	842	085	Changed A4R28 from 1M, 1/4W, 5% to 1M, 1/2W 1%	G C 8-70		
E	841	086	Changed PRESET FUNCTION	G C 8-70		
F	1068	011	Circuit Card A4 changed from Assy 11214-3 to Assy 14846-1 added diodes CR3 thru CR14 to wipers of controls R1 thru R6.	T. S. 2-72		

NOTES:

UNLESS OTHERWISE SPECIFIED: ALL RESISTANCE VALUES ARE IN OHMS ±5% ALL CAPACITANCE IN MICROFARADS 200V ±10%

SYMBOL [ ] INDICATES [illegible] PANEL

SYMBOL [ ] INDICATES REAR CHASSIS LOCATION

△ FACTORY SELECTED WITH OPTIMUM VALUE SHOWN

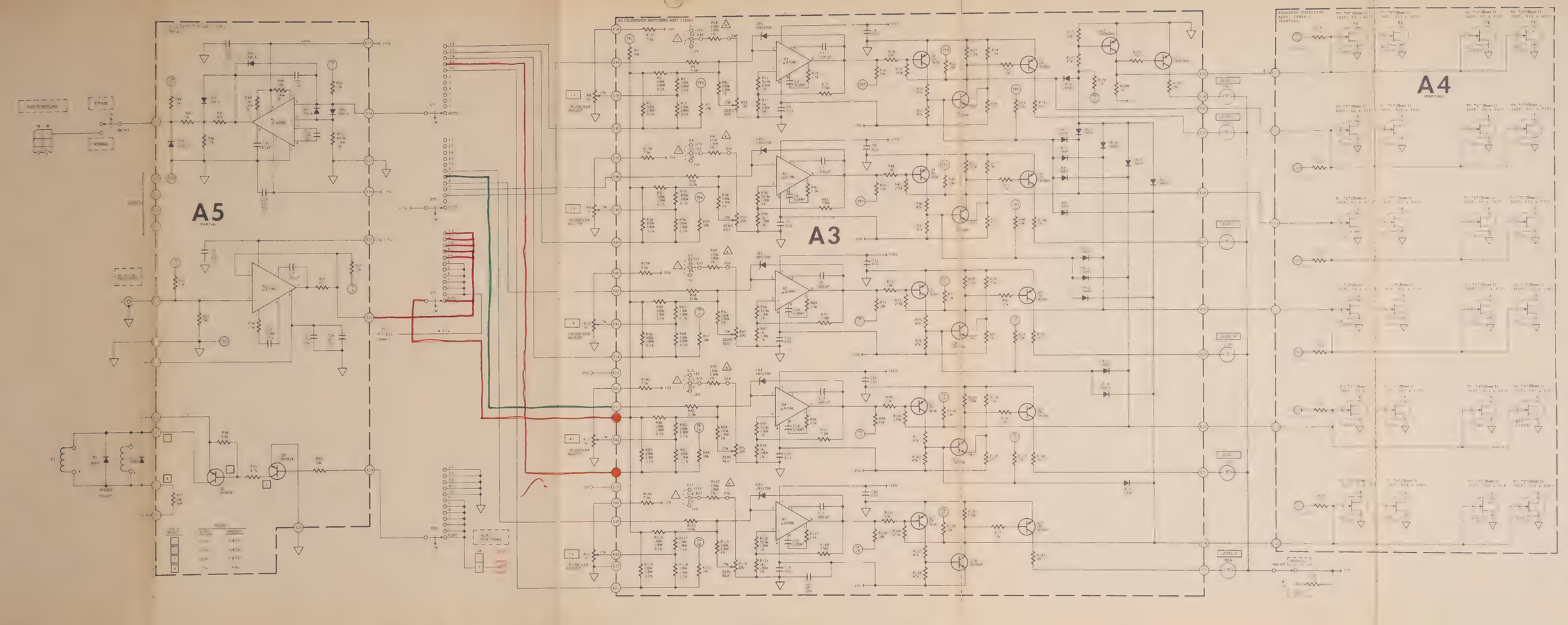
△ POLARITY IS FACTORY ADJUST

△ JUMPER DETERMINED DURING FACTORY CALIBRATION

△ 15V OR -15V SELECTED DURING FACTORY CALIBRATION

ASSEMBLY
11208-3 (A5)
14638-1 (A7)
INTERCONNECT

SPECTRAL DYNAMICS CORPORATION OF SAN DIEGO	SCHEMATIC/COMPONENT LAYOUT MODEL SD117A AUTOMATIC LEVEL PROGRAMMER
	11478 F



NOTES & REVISIONS: See Sheet 1.

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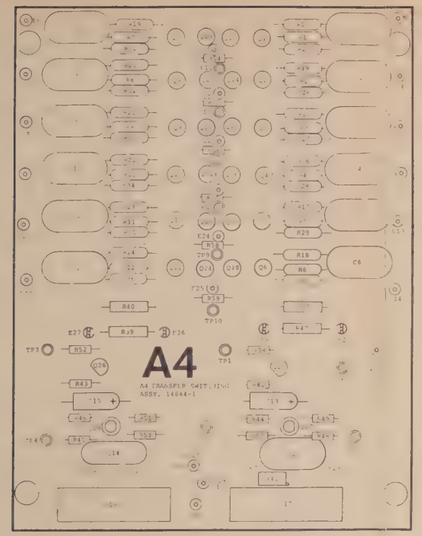
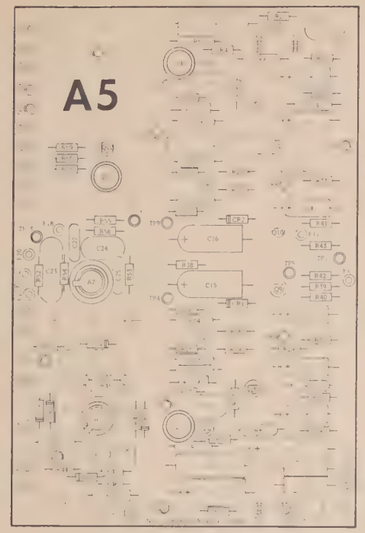
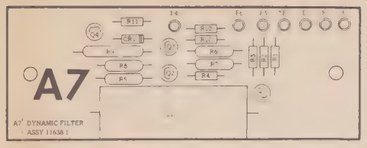
SPECTRAL DYNAMICS CORPORATION OF SAN DIEGO

SCHEMATIC/COMPONENT LAYOUT—
MODEL SD117A
AUTOMATIC LEVEL PROGRAMMER

11478 F







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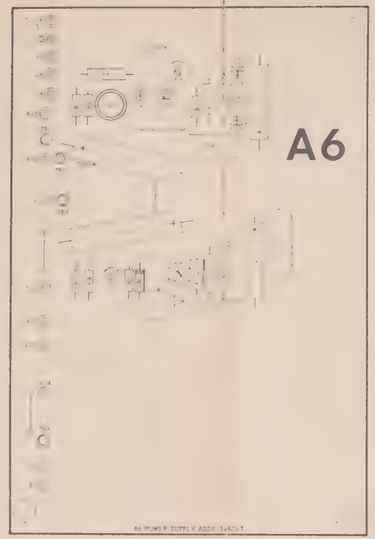
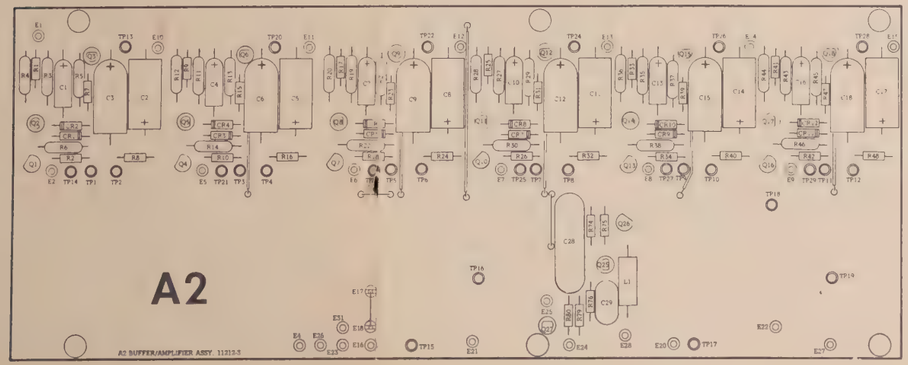
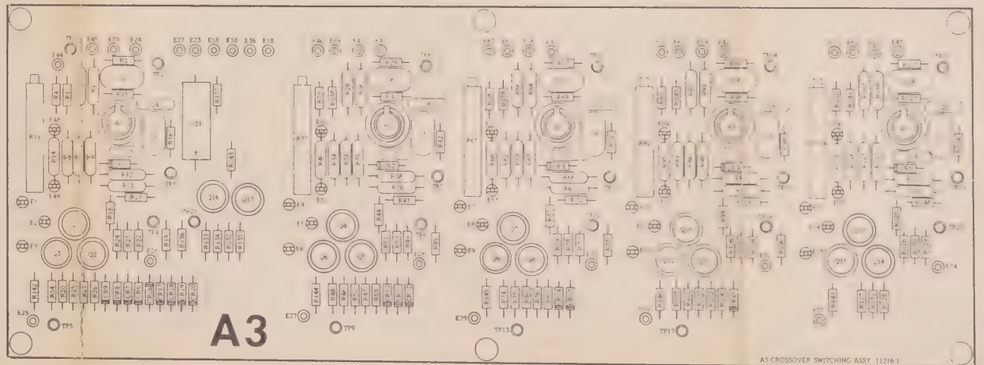


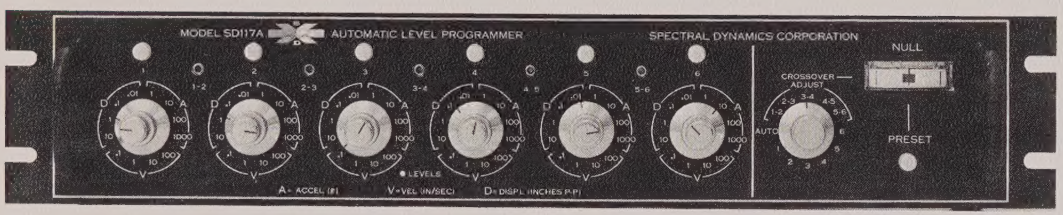




NOTES & REVISIONS See Sheet 1

SPECTRAL DYNAMICS CORPORATION OF SAN DIEGO	SCHEMATIC/COMPONENT LAYOUT— MODEL SD117A AUTOMATIC LEVEL PROGRAMMER
	DRAWING NO. 11478 F
	SHEET 3 OF

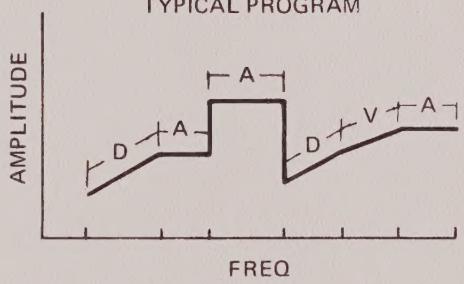
MODEL SD117A AUTOMATIC LEVEL PROGRAMMER (ALP)



FEATURES

- Six Levels — Five Crossover Frequencies
- Solid-state switching — no relays
- Complete preset of test level profile
- Stepped A, V or D capability
- Displacement and velocity control up to 1000 Hz
- Limited rack space required (3-1/2" x 19" x 14")

TYPICAL PROGRAM

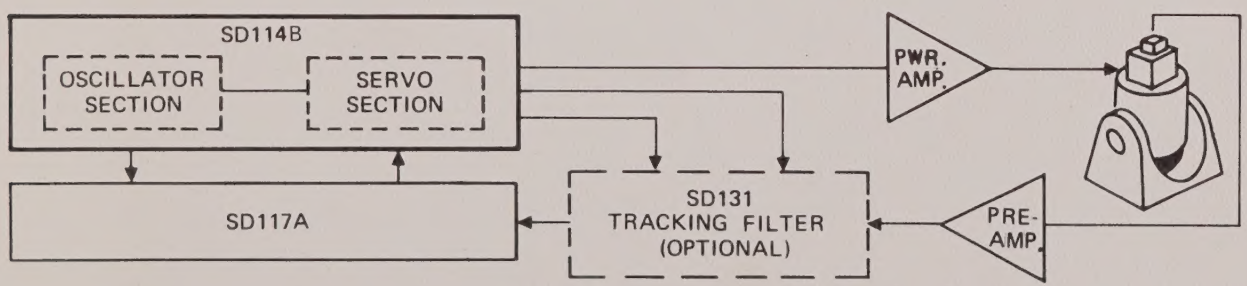


GENERAL DESCRIPTION

The Model SD117A Automatic Level Programmer (ALP) was designed specifically for use with the Model SD114B Sweep Oscillator Servo. The SD117A ALP programs acceleration, velocity or displacement in any of six available channels and can be used for both stepped A, V or D tests as well as the standard D to A, A to D, V to A, etc. crossover tests.

Relays are not used in the SD117A ALP for performing the crossover functions. A null meter on the front panel of the ALP allows for accurate setting of smooth crossover points to eliminate "thumps." The crossover frequency is indicated on the SD114B Sweep Oscillator Servo and is automatically programmed in the preset mode using the "NULL" feature.

APPLICATION



Multi-Level Sine Servo Application

SPECTRAL DYNAMICS CORPORATION OF SAN DIEGO
POST OFFICE BOX 671, SAN DIEGO, CALIFORNIA 92112
TELEPHONE 714-[redacted] 565-8211 • TWX 910-335-2022

3-74
S-027

SPECIFICATIONS*

INPUT

FREQUENCY RANGE . . . . . 5 Hz – 5 kHz

ACCELERATION

Sensitivity . . . . . 10 mV (peak)/g(peak)
Impedance . . . . . 80 kΩ

SINE WAVE (used in null preset feature)

Amplitude . . . . . Fixed amplitude sine wave from SD114B Sweep Oscillator Servo

DC ∝ LOG FREQUENCY (used for crossover switching)

Amplitude . . . . . 0 to 1 Vdc from SD114B Sweep Oscillator Servo

OUTPUT

ACCEL (connects to Accel Input of SD114B Sweep Oscillator Servo)

Impedance . . . . . <600Ω
Full Scale Ranges . . . . .

Accel (g) (5–5,000 Hz)	Velocity (in./sec) (5–1,000 Hz)	Displ (in. p-p) (5–1,000 Hz)
1000	100	10
100	10	1
10	1	0.1
1	0.1	0.01

MISCELLANEOUS

INPUT/OUTPUTS . . . . . BNC connectors on rear of chassis

POWER . . . . . ±38 Vdc, at ≈25W, supplied by the SD114B Sweep Oscillator Servo

DIMENSIONS . . . . . Height . . . . . 8,89 cm (3-1/2")
Width . . . . 48,3 cm (19") (standard panel)
Depth . . . 35,6 cm (14") (w/o connectors)
Shipping Weight . . . . . 4,53 kg (10 lbs.)

ACCESSORIES SUPPLIED . . . . . Two Instruction Manuals and multi-pin connectors

*Specifications subject to change without notice.